Rhode Island Environmental Monitoring Collaborative

2010-2011 Summary Report: Current Initiatives & Future Challenges

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Information is the currency of democracy.
Thomas Jefferson

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Preface

System approaches to environmental management and economic development demand comprehensive scientific knowledge, baseline and targeted monitoring, indicator-based analysis and communications.

Environmental monitoring sustains and guides all aspects of environmental policy and management, from water quality to living resources management. Environmental monitoring generates essential insights into how environmental management initiatives and programs are advancing toward key protection, conservation, and restoration goals established in federal, state, and municipal law and interagency strategic plans.

With passage of the 2004 Comprehensive Watershed and Marine Monitoring Act, the RI General Assembly established the RI Environmental Monitoring Collaborative (RI Env-MC) as an:

> *Integrated mechanism by which individual monitoring efforts can be coordinated and managed as a system in which the functionality of Narragansett Bay and its watersheds is measured and individual planning and management efforts are adjusted to respond to the needs of [the state's] marine environment.*

The RI Env-MC is responsible for development and implementation of a:

> *state monitoring strategy that addresses critical state resource management needs, including, but not limited to, water quality protection, water pollution control, fisheries and wildlife management, habitat restoration, coastal management, public health protection and emergency response and that assesses and tracks environmental health and function.*

The RI Env-MC coordinates and promotes collaboration among executive agencies, university-based programs, non-governmental organizations, and other monitoring stakeholders. The RI Env-MC functions as a standing committee of the RI Bays, Rivers, and Watersheds Coordination Team, a seven state agency commission charged with setting overall goals for water resources management in Rhode Island and working together to make progress toward those goals. Given the recent erosion of federal and state funding for environmental monitoring, and mounting concern about additional larger cuts, the imperative has only strengthened for continuous coordination and partnership among individual organizations engaged in monitoring, data processing, analysis, and communications. This report from the RI Env-MC summarizes progress toward ten critical environmental monitoring priorities in the period of 2010-2011, and identifies challenges, particularly fiscal challenges, the RI Env-MC must address in the coming years.

The generators, researchers, students, and innumerable beneficiaries of environmental monitoring data must communicate and engage elected leaders and the general public

regarding the critical importance of comprehensive environmental monitoring. Environmental monitoring guides strategic management and planning, supports innovation in environmental governance and regulation, and fosters technical and science careers, jobs, and development. Without comprehensive environmental monitoring, we will be unable to manage successfully current and future risks to human and environmental health, resilience, and well-being. In turn, Rhode Island's economic health depends on a healthy natural environment.

Federal and State Budgetary Support for Environmental Monitoring

Over the last decade, the U.S. federal government has provided substantial support for environmental monitoring programs in Rhode Island. Unfortunately, as federal agencies such as the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and the U.S. Geological Service grapple with flat or declining budgets, they have been obliged to cut funding previously provided to the states for environmental monitoring, as well as management and science. Federal funds for baseline monitoring programs, from fisheries stock assessments to beach water quality, are expected to shrink over the coming years, perhaps substantially. Environmental monitoring stakeholders in Rhode Island and across the U.S. are deeply concerned about the future sustainability of environmental monitoring programs. If federal funds and operations support for environmental monitoring initiatives are cut significantly across the numerous state and federal programs that provide these services and information, what alternative funding sources will made available for local, state, and regional monitoring needs and requirements?

RI monitoring stakeholders are already coping with monitoring program cuts. In 2010 and 2011, monitoring efforts that have ended or were newly curtailed include:

- NOAA National Marine Fisheries Service ceased its monthly multi-parameter surveys of Narragansett Bay in 2010. Previously, federal funds provided via the Bay Window Program supported this survey program.
- Staffing and budgetary reductions continue to prevent the Rhode Island Department of Environmental Management (DEM) from implementing a fish tissue contaminant sampling program.
- Staffing and budgetary reductions delayed implementation of SWIMS (State Water Information Management System) by DEM's Office of Water Resources.

Additionally, the RI Env-MC has identified a number of monitoring programs that are *at risk of disruption* due to funding uncertainties or expected funding cuts. These include:

- Dissolved-Oxygen Field Surveys in Narragansett Bay: The Bay Windows Program contributed annual support to the boat-based, field survey component of Rhode Island's seasonal dissolved oxygen (DO) monitoring program. For 2012, the RI Bays, Rivers, and Watersheds Coordination Team (BRWCT) provided $10,000 to the boat survey (operated by the Narragansett Bay Estuary Program and Brown University). However,

this funding will only enable data collection. Additional funding is still needed for data analysis and mapping.

- The Rhode Island Stream Gage Network: In Rhode Island various public entities contract with USGS to operate a network of 36 stream gages that provide continuous streamflow data. In recent years, state funding for stream gages previously provided through the budgets of the RI Water Resources Board (WRB) and DEM's Office of Water Resources was eliminated, compelling DEM and WRB to request that BRWCT monitoring funds be provided in place of the cut funds. Hence, since 2008 the RI BRWCT has provided substantial 'stop-gap' support to maintain the state's stream gage network. The BRWCT is concerned that it will be unable to terminate this stop-gap support without jeopardizing the long-term value of ongoing stream gage data collection. This stop-gap support also prevents the BRWCT from targeting support to monitoring needs that have never been fulfilled, such as water quality monitoring at RI's freshwater beaches.

- RI Department of Health Coastal Beach Water Quality Monitoring: U.S. EPA's FY 2013 budget proposes to end annual funding to support water quality monitoring at coastal beaches. In Rhode Island, that funding provided approximately $212,000 per year to the Department of Health (DoH) to sample and report on the safety of the state's beaches for swimming and recreation. DoH had initiated comprehensive and innovative survey and communications approaches that had significantly shortened the time between sampling and announcing results. While funds currently awarded to DoH may allow the program to continue into 2013 it will be necessary to evaluate and prepare for the likelihood that funding will not be available for 2014. Alternative funding sources must be identified now in order to be prepared for the anticipated loss of EPA funding for FY 2014.

Rhode Island faces a major policy and budgetary challenge on how to identify and cultivate new, stable funding sources that will replace federal and state funds that have been and will continue to be lost. The failure to meet this challenge and the ensuing loss of long-term, baseline monitoring programs will stifle credible efforts to improve the cost-effectiveness and innovativeness of environmental management policies, plans, and regulations.

Meeting Current Needs and Preparing for Future Challenges in Environmental Monitoring: Progress in 2010-2011

In 2010-2011, the RI Env-MC focused on sustaining vital monitoring activities and maintaining, as best as possible, the collective capacity of Rhode Island's monitoring programs through partnership and coordination. Despite significant fiscal constraints facing all levels of executive government, and university-based monitoring, research, and outreach programs, the monitoring collective has succeeded continuing many existing monitoring programs considered critical to state management decision-making. For example, DEM successfully secured an alternative source of stable funding to continue to fund its portion of the Narragansett Bay Fixed Site Monitoring Network (NBFSMN, see below).

The sponsoring agencies of monitoring programs that have funding vulnerabilities or uncertainties are actively exploring alternative funding options, with a goal of securing sustainable funding for core monitoring needs and requirements. Through communication and collaboration amongst it members, the RI Env-MC seeks to develop ways and means to avert further loss of critical monitoring capacity in order to ensure that generation of essential environmental data and information for environmental policy, management, and regulation.

New Environmental Monitoring Initiatives

In the course of exercising their environmental management responsibilities, federal, state, and local agencies frequently encounter additional information needs that cannot be fulfilled by existing long-term monitoring programs. Therefore, monitoring authorities and experts devote considerable effort to exploring, designing, and pursuing new monitoring initiatives. Sometimes new initiatives can be incorporated into existing monitoring programs; more frequently new information needs require additional staff time and equipment. The pursuit and execution of ecosystem-based management principles demands extensive baseline knowledge about how ecosystems and natural resources function and are changing over time. As a result of much effort and creativity, and despite significant fiscal constraints, in 2010-2011 several organizations that are part of the RI Env-MC launched several monitoring initiatives and program enhancements. These accomplishments are described briefly below.

Cyanobacteria – Blue-Green Algal Blooms

Growing awareness of the presence of blue-green algae in RI freshwaters prompted DEM and DOH to initiate a limited, targeted program aimed at confirming the presence of cyanobacteria and issuing public health advisories when appropriate. Explosive growth of cyanobacteria, which are naturally occurring, produces algal blooms which may pose a public health threat due to the release of natural toxins. DEM collected samples from targeted lakes as well as from other water bodies in response to public complaints. Where warranted, samples were processed at an out-of-state laboratory in order to identify the algal species, quantify cell counts and assess the level of natural toxins present. The program confirmed cyanobacteria blooms in 4 lakes in 2010 and 6 lakes in 2011. Additional funding will be needed to expand the current effort to fulfill an anticipated increase in public demands for assessment of possible blue-green algal blooms. For more information see http://www.health.ri.gov/healthrisks/poisoning/cyanobacteria/index.php

Characterization of Lakes to Support Nutrient Criteria Development

DEM is currently conducting work to refine the numeric nutrient criteria for lakes, ponds and reservoirs. As part of this work DEM needs to categorize lakes based on certain intrinsic characteristics. To secure needed data, DEM, in collaboration with the New England Interstate Water Pollution Control Commission, executed a lake monitoring program during 2011 that involved sampling 72 lakes for color as well as several other water quality parameters. The data collected will be used in conjunction with data from the URI Watershed Watch program to

continue the work on developing refined nutrient criteria. For lakes, the focus is on the nutrient phosphorus.

Narragansett Bay Commission – Snapshot of Upper Narragansett Bay

In June 2011, the Narragansett Bay Commission (NBC) unveiled its new water quality website, *Snapshot of the Upper Narragansett Bay*: http://snapshot.narrabay.com/app/.

The site describes the NBC's comprehensive receiving water environmental monitoring program, which is divided into six discrete initiatives:

- fixed-site monitoring
- water quality profiles
- surface mapping
- bay pathogen monitoring
- nutrient monitoring
- water clarity

For each sampling program, *Snapshot of the Upper Narragansett Bay* briefly describes sampling methods and sample locations (including photos) and summarizes historic results. The website also provides recent and contemporary monitoring data which is frequently updated. All monitoring data can be downloaded.

The site also provides current data on tides, weather and near real-time water quality results from the NBC's two fixed site monitoring stations located in the Seekonk and Providence Rivers. The fixed site web page allows graphing of selected parameters and downloading of the data in a format readily usable by managers, researchers and the public.

The NBC Snapshot website represents a comprehensive look at water quality in Upper Narragansett Bay by providing the general public with near real-time data and a wide range of information regarding water quality in upper Narragansett Bay.

Watershed Counts

In May, 2010, the RI Env-MC agreed to build upon the work of the Narragansett Bay Estuary Program's (NBEP) Status and Trends Program via the development and refinement of environmental indicators initially conceptualized in the 2009 NBEP Status and Trends Report, *Currents of Change*. The RI Env-MC asked the NBEP and the URI Coastal Institute (URI CI) (the URI CI chairs the RI Env-MC) to continue to develop and refine indicator metrics, as well as tools for assessment and public communication. This initiative, *Watershed Counts* (www.watershedcounts.org), builds upon the 2009 *Currents of Change* Report and helps fulfill the RI Env-MC's responsibility to foster development of environmental indicators as part of the state's environmental monitoring system.

In 2010-2011, Watershed Counts brought together numerous agencies, academic institutions and NGOs throughout the bi-state watershed to develop and refine five environmental indicators**: impervious cover, freshwater flows, saltwater beach closures, terrestrial and aquatic invasive species, and climate chang**e (sea level rise, sea surface temperature, storminess).

Work continues in 2011-2012 to develop indicators that focus on **protected lands, river and stream water quality, and Narragansett Bay water quality**. Work continues on all eight indicator areas to refine metrics and data analysis procedures and reporting.

Watershed Counts utilizes actual monitoring data to develop communications and educational offerings to policy-makers, management agencies, educators, and the public. The RI Env-MC will work to link together the indicators and education generated by Watershed Counts, other sets of environmental indicators and outreach initiatives, to field monitoring programs, and management planning and regulation. Over time, those who collect, study, and utilize environmental monitoring data through the RI Env-MC have the opportunity to organize and assemble a robust and responsive environmental monitoring system for Rhode Island and southern New England.

Review of Long-Term Environmental Monitoring Priorities for Rhode Island and southern New England

In 2004-2005, the RI Env-MC conducted a major review of RI's water monitoring activities in order to identify key information gaps and the monitoring activities necessary to eliminate these gaps. In its November 2005 report to the RI Bays, Rivers and Watersheds Coordination Team (BRWCT), the RI Env-MC identified ten essential monitoring needs for advancing that State's environmental monitoring strategy. Since the 2004-2005 review, the RI Env-MC has tracked and reported annually on implementation of its priority monitoring needs. **Table One** summarizes the implementation status of the RI Env-MC's 2005 top environmental monitoring priorities through 2011. (**Appendix A** summarizes Rhode Island's major monitoring programs and provides websites where monitoring data are available). Detailed discussion of each monitoring priority follows Table One.

It is important to note the monitoring priorities discussed in this report do not encompass the full suite of RI environmental monitoring programs (See Appendix A for a more comprehensive list), only the top monitoring priorities recognized in 2005 by the RI Env-MC, from dissolved oxygen (DO) levels in upper and mid-Narragansett Bay to invasive species. After nearly seven years, the RI Env-MC should review its previous prioritization effort and provide updated recommendations to the BRWCT on environmental monitoring priorities for Rhode Island and southern New England. This Report will be an important part of this forthcoming review.

Table One shows that while progress has been made in six of the ten priority monitoring areas, many important monitoring needs are not being met. For the six monitoring priorities for which there is progress, about **$320,000 annually** is still required in order to fully implement these key

monitoring programs. About **$535,000 annually** is required to implement the four monitoring priorities that Rhode Island and its partners are still not pursuing. The funding shortfall for Rhode Island's critical environmental monitoring needs now totals about **$855,000 annually**. This does not include the cost of emerging environmental monitoring needs or adequately supporting current monitoring programs such as those in aquatic invasives and shoreline erosion.

Table One: Implementation Status of RI Environmental Monitoring Collaborative Priority Monitoring Needs, 2010-2011

RI Env-MC Priorities	Utility & Value	Program Status	Current Funding	Future Funding
Maintain and expand Narragansett Bay fixed-site monitoring network (NBFSMN)	Tracks dissolved oxygen concentrations and related parameters; data that is required for the assessment of water quality improvements due to wastewater treatment upgrades and other pollution control actions.	Partially Implemented	RI State Revolving Fund; Narragansett Bay Commission (NBC); Narragansett Bay Nat. Estuarine Research Reserve (NBNERR)	Funding for the NBFSMN is **stable**, assuming that federal funding for RI State Revolving Fund is not cut significantly. Previously proposed system expansion to lower bay stations has not been funded.
Maintain field surveys of dissolved oxygen in upper Narragansett Bay	Enables the collection of DO throughout upper and mid-Narragansett Bay as complement to the fixed-site network. Identifies Bay areas and embayments at significant risk for low DO events.	Partially Implemented	BRWCT; NBEP; NBC; NOAA Coastal Hypoxia Research Program (NOAA-CHRP)	**RI FY 2013 projected shortfall: $30,000**
Monitor water quality in large rivers	Generates water quality data for major river systems. Essential for assessing Narr. Bay water quality, and for evaluating trends in river flow and pollutant loadings into coastal waters. 6 of 8 recommended stations are monitored.	Partially Implemented	BRWCT, NBC	State portion of this program is supported by BRWCT discretionary funding
Monitor water quality in smaller rivers and streams (rotating assessment)	Generates data required for assessing water quality in rivers and streams; and used in water pollution control programs.	Partially Implemented	DEM, EPA	**RI FY 2013 projected shortfall: $140,000**
Monitor for the appearance and spread of invasive species	Data critically needed to enable early detection and rapid response to the arrival or expansion of terrestrial and aquatic invasive species**. Lack of early detection and rapid response capabilities greatly increases long-term costs of invasives species eradication and management.**	Partially implemented	US Fish & Wildlife; RI Coastal Resources Management Council (CRMC); DEM; RI Natural History Survey; NBEP	Limited funding available. **RI FY 2013 projected shortfall: $150,000**

Table One: Implementation Status of RI Environmental Monitoring Collaborative Priority Monitoring Needs, 2010-2011

Monitor river and stream flows	Flow data from RI's stream gage network is vital to water supply planning and management, flood response, flood risk mitigation, drought management, water quality management and pollution control.	Partially Implemented	RI Water Resources Board; Providence Water Supply Board; RI Bays, Rivers, & Watersheds Coordination Team	DEM Office of Water Resources lost state funding for the stream gages it had historically funded. RI BRWCT has provided discretionary funds to maintain DEM's stream gages for the past three state fiscal years.
Monitor water quality in coastal waters of concern (rotating assessment)	Would address major data gaps regarding water quality in coastal coves and embayment water quality. This data is essential for assessing current point and non-point source pollution control efforts such as sewering in Greenwich Bay watershed, cesspool phase-outs, and stormwater management.	**Not implemented**; some data collected by DEM and volunteers.	**No funding available**	**Annual Cost: $ 250,000 Potential funding source not identified**
Monitor water quality at freshwater beaches	Freshwater beaches make up almost half of the RI's licensed beaches but are monitored infrequently at owner expense. **Of particular concern are freshwater beaches at summer camps utilized by thousands of children.**	**Not implemented**	**No funding available**	**Annual Cost: $100,000 Potential funding source not identified**
Monitor water quality in un-assessed lakes	Volunteers provide critical water quality monitoring data for the state's lakes and ponds. However, 25% of the state's total lake acreage remains un-assessed, significantly constraining statewide water quality assessments and management.	**Not implemented**	**No funding available**	**Annual Cost: $80,000 Potential funding source not identified**
Monitor mercury contamination in freshwater fish	Bio-accumulated mercury concentrations in freshwater fish are a major public health concern throughout New England. **Actual levels of mercury contamination in RI freshwater fishes (and hence public health risks) remain largely un-assessed**.	**Pilot project curtailed in 2009**	DEM, EPA	**Annual Cost: $105,000 Potential funding source not identified**
				Total Projected Shortfall: $855,000

Program: Narragansett Bay Fixed-Site Monitoring Network (NBFSMN)

Description: The NBFSMN is a multi-agency collaborative established to equip, operate, and conduct data analysis and reporting a multi-station monitoring network for Narragansett Bay. The system simultaneously collects data on fundamental water quality parameters across upper Narragansett Bay every year from May to October. During 2010-2011, the NBFSMN operated with a total of thirteen locations: eight buoys and five shore-based sites. The Network is standardized on YSI equipment. It measures water quality parameters every 15 minutes, 24 hours per day, with three stations providing near real-time data on the web. Four land-based stations and one buoy operate year-round. Monitored parameters include: temperature, salinity, dissolved oxygen (DO), turbidity and chlorophyll.

It's important because…
This data is a pre-requisite for the assessment of water quality impairments in Narragansett Bay, and the efficacy of major wastewater treatment plant upgrades.

Implemented by: DEM, URI GSO, NBC, NBNERR

Used by: DEM, URI GSO, NBC, NBNERR, environmental managers, researchers

Management Values:

- Track Bay water quality conditions in near real-time throughout the bay providing a high resolution data set, both temporally and spatially.
- Track improvements to upper Narragansett Bay water quality during warm weather months that are anticipated as wastewater treatment upgrades are implemented and pollutant loadings reduced.
- Provides early warning of hypoxia events (significant losses of dissolved oxygen concentrations).
- Provides critical data for the state assessment of water quality impairments in upper and mid-Narragansett Bay. In 2008 DEM designated an additional 7.62 square miles of mid-Narragansett Bay as impaired due to low dissolved oxygen.
- Researchers and managers use these data with other physical, chemical, and biological data to improve understanding of the causes of eutrophication and hypoxia in upper and mid-Narragansett Bay.

Data At:

http://www.dem.ri.gov/bart/stations.htm
www.narrbay.org (raw near real-time data)
http://nerrsdata.org/get/realTime.cfm?stationCode=NARTBWQ (raw near real-time data)
http://www.dem.ri.gov/bart/netdata.htm (processed datasets 2003 – 2010)

Current Funding:

FY 2012 RI Clean Water State Revolving Fund, NBC, and NBNERR
FY 2011 RI Clean Water State Revolving Fund, NBC, and NBNERR
FY 2010 NOAA Bay Window (summer 2010), RI BRWCT, NBC, and NBNERR

Future Funding: Stable

The network partners expect to be able to utilize existing funding sources for the next several years.

Program: Upper Narragansett Bay Dissolved Oxygen Field Surveys

Description: The Narragansett Bay Estuary Program (NBEP), Brown University and Save the Bay conducted boat-based DO surveys in 2010 and 2011. On six days every summer during neap tides when DO is expected to be lowest, this water quality survey program collects water column profile data (temperature, salinity, and DO) at about seventy-five stations throughout the Providence and Seekonk Rivers, Greenwich Bay, and the East and West Passages of Narragansett Bay. The Narragansett Bay Commission (NBC) collects similar data at five Providence River and upper bay monitoring stations (Bullock's Reach, Conimicut Point, Edgewood Yacht Club, Pomham Rocks, and India Point). Sampling occurs year round, weekly during the summer and twice per month for the remainder of the year. The NBC data set consists of DO, temperature, salinity, density, depth, and photosynthetic active radiation (PAR), a measure of the photic zone.

Implemented by: NBEP, Brown University, Save the Bay, and NBC

Used by: DEM, NBC, EPA, academic researchers

Management Values:

- Presents cross section of the water column to determine periods of high stratification which can lead to low DO conditions.
- Provide a comprehensive temporal and spatial dataset that complements the time-series dataset generated by the NBFSMN system.
- Provide information on the inter-annual variability and severity of hypoxic and anoxic events in Narragansett Bay.

Data at:

http://www.geo.brown.edu/georesearch/insomniacs/index.html
http://snapshot.narrabay.com/app/WaterQuality/Profiles

Current Funding:

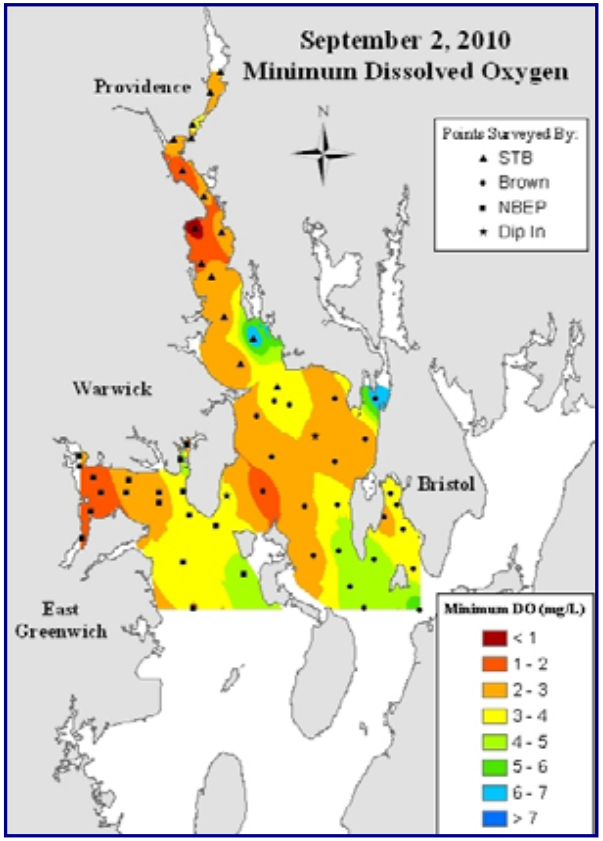
FY 2012 BRWCT, NBEP, NBC, NOAA-CHRP
FY 2011 NOAA-CHRP, EPA, BRWCT, NBC
FY 2010 NOAA Bay Window Program, NOAA-CHRP, EPA, NBC

Future Funding: Vulnerable to Disruption

The NBEP-led survey continued in 2011, with curtailments in processing of data and map development. RI BRWCT stop-gap funding support will enable the NBEP-led survey to continue in 2012, but data analysis and mapping will not be undertaken.

It's Important because . . .

The DO field surveys are essential to characterizing the extent of low oxygen events occurring in Narragansett Bay and to assessing management efforts.



Narr. Bay Estuary Program; Brown University.

Program: Rotating Assessment of Critical Coastal Waters

Description: The RI Water Monitoring Strategy: 2005-2010 recommends sampling RI's coastal waters on a rotating basis, similar to the program design DEM utilizes to monitor RI's smaller rivers and streams. Narragansett Bay-wide monitoring strategies cannot collect data on the conditions in coves and embayments. DEM's Shellfish Water Quality Monitoring Program collects bacteriological data throughout RI coastal waters, including the including the Salt Ponds, but it does not collect data on other important water quality parameters. On a more limited basis, URI-WW volunteers, and applied researchers collect monitoring and other types of data on coastal embayments and coastal ponds. The Narragansett Bay National Estuarine Research Reserve (NBNERR) is able to provide water quality data collection for critical coastal waters utilizing its boat-based DATAFLOW monitoring system. The Coastal Waters Rotating Assessment Program would complement other core monitoring programs and research efforts by generating water quality data for coastal waters of critical concern, such as Greenwich Bay and the Salt Ponds. Data gaps regarding the southwestern coastal ponds are considered a priority due to worsening or vulnerable water quality.

It's important because…
Coastal embayments and lagoons have unique circulatory regimes, biota, and watershed dynamics that create management challenges distinct from those of managing the entire Narragansett Bay. Targeted water quality monitoring of these coastal waterbodies is essential for managing their diverse resources and high productivity, and ensuring the continuation of their many socio-economic values.

Implemented by: **Not Currently Implemented**

Used by: DEM, CRMC, watershed organizations, researchers

Management Values:

- Track changing conditions in the Bays coves, embayments and coastal ponds
- Track effects of wastewater and stormwater management efforts currently underway
- TMDL development

Current Funding: **No funding available**

RI Dept. of Environmental Management

Program: Large River Water Quality Monitoring

Description: With BRWCT support, the DEM contracts with the US Geological Survey (USGS) to sample monthly six stations (sites) located on the Blackstone, Branch, Pawtuxet, and Pawcatuck Rivers. The data from these stations enable the assessment of water quality in rivers with large watersheds or drainage areas, and support trends analysis. Over a dozen water quality parameters are sampled, including nutrients and pathogens. Metals are sampled quarterly. This data are critical to tracking long-term trends in river flow and riverine pollutant loading to coastal waters, including Upper Narragansett Bay. In addition, the Narragansett Bay Commission conducts water quality sampling in all the river tributaries to upper Narragansett Bay. Aimed at characterizing nutrient pollutant loadings, samples are analyzed for the full suite of nitrogen parameters, orthophosphate, total suspended solids and dissolved organic carbon.

It's important because…
The state's largest rivers systems receive wastewater and stormwater discharges and are known to experience water quality issues. They also are a significant source of nutrients and chemical and biological contaminants to Narragansett Bay.

Implemented by: USGS, DEM, NBC

Used by: DEM, USGS, NBC, RI Water Resources Board (WRB), researchers, Watershed Organizations

Management Values:

- Evaluate long-term trends in riverine water quality
- Track pollutant loadings into the Upper Bay from large rivers
- Determine pollutant loadings from MA portion of watershed (Blackstone, Runnins, Palmer, Kickemuit, Cole, Lees and Taunton)
- Determine pollutant loadings to coastal waters (Blackstone, Pawtuxet, Pawcatuck)
- Development of discharge permit limits and water quality modeling

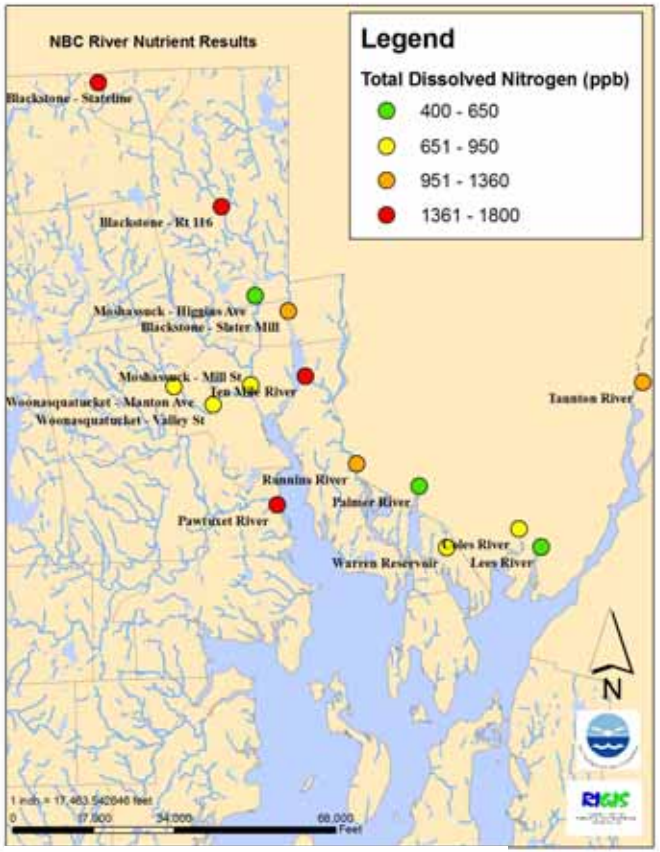
Data Available at:

http://waterdata.usgs.gov/ri/nwis/current/?type=quality&group%20Key=basin%20cd
http://snapshot.narrabay.com/app/WaterQuality/NutrientMonitoring

Current Funding:

FY 2012	BRWCT, NBC
FY 2011	DEM, BRWCT, NBC
FY 2010	DEM, BRWCT, NBC

Future Funding: Vulnerable to Disruption
The cooperative agreement with USGS is subject to annual renewal of BRWCT funding. The NBC monitoring continued in 2011 and funding has been secured through the 2012 monitoring year.



Cumulative Averages: 2006-2011

Program: Monitor wading rivers and streams (rotating assessment)

Description: In 2011, the DEM Office of Water Resources initiated the second cycle of ambient river and stream monitoring collected under the rotating basin monitoring strategy for wading rivers and streams. For the second cycle of its rotating basin strategy, DEM reviewed and adjusted the number of river and stream sampling stations based on what was learned from the first cycle, input from water management programs as well as the local watershed organization. Sampling occurred at **58** stations in the Wood-Pawcatuck Watershed region and included chemical, physical and biological (macroinvertbrates) parameters. This program is implemented by DEM, in collaboration with the New England Interstate Water Pollution Control Commission (NEIWPCC), with laboratory analysis services from the RI Department of Health (DoH) and the ESS Group, Inc. (collection and taxonomic ID of macroinvertebrates).

It's important because…
It enables Rhode Island to reduce the percent of un-assessed rivers and streams and identify additional river segments that exhibit poor water quality or degraded aquatic habitat so management and restoration plans can be initiated.

Implemented by: DEM, NEIWPCC, DoH, ESS Group, Inc.

Used by: DEM, EPA, watershed organizations, researchers

Management Values:

- Assessment of water quality in wading rivers and streams
- Data to support permitting decisions
- Data to support development of water quality bio-criteria
- Water quality restoration planning (TMDL development)

Data at: Can be requested by contacting Connie Carey at the DEM Office of Water Resources

Current Funding:

FY 2012 DEM, EPA
FY 2011 DEM, EPA
FY 2010 DEM, EPA

Future Funding: Vulnerable to disruption
Reductions in staffing and federal funding may adversely affect the continuation of this program following 2012.

DEM, Office of Water Resources

Program: RI Streamflow Gage Network

Brief Description: In Rhode Island, a network of 36 stream gages is maintained by USGS to provide continuous streamflow data. USGS operates and maintains under contracts with the BRWCT, the RI Water Resources Board (WRB), the Providence Water Supply Board (PWSB), and Ocean State Power. Data is available in real-time via the USGS website. Data include long-term statistical analyses specific to each gage in the network.

It's important because…
Data on streamflow is essential for numerous types of water resources management decisions, from establishing minimum stream flow standards, to preparing for and managing droughts, to floodplain management.

Implemented by: USGS

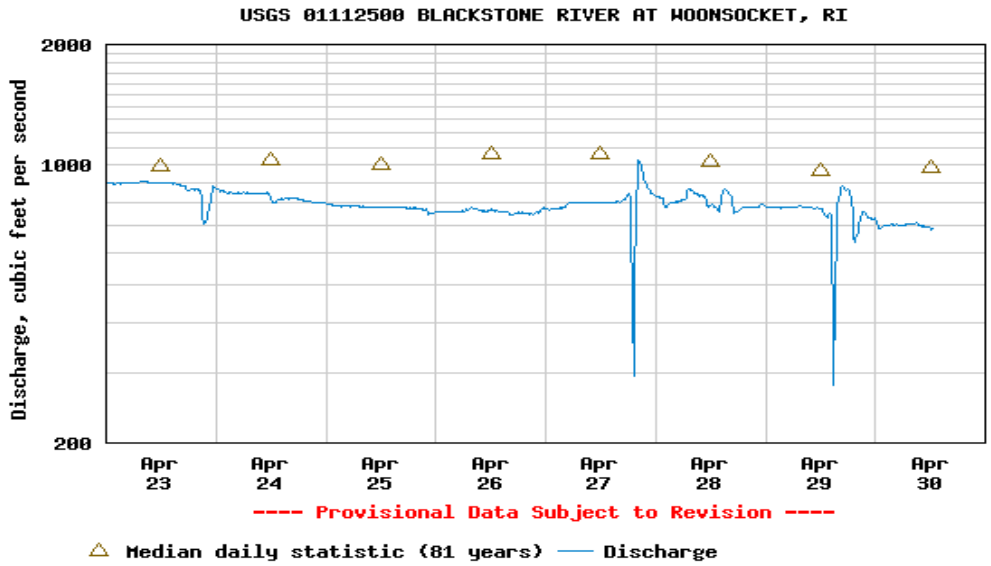
Used by: DEM, WRB, USGS, PWSB, NBC, researchers

Management Values:

- Development of minimum flow standards
- Pollutant loading calculations
- Development of water quality restoration plans
- Water quality & quantity modeling
- Drought management
- Emergency (e.g., floodplain) management
- Basin planning related to water supply
- Water supply development planning in Big River Watershed

Data at:

http://waterdata.usgs.gov/ri/nwis/current/?type=flow



Current Funding:

FY 2012 PWSB, Ocean State Power
FY 2011 BRWCT, WRB, PWSB, Ocean State Power
FY 2010 BRWCT, WRB, PWSB, Ocean State Power

Future Funding: Vulnerable to Disruption

Reductions in state funding have led to an increased reliance on the BRWCT. BRWCT funding will continue to be relied upon for funding a portion of the state-funded gauges in FY 2013 and beyond; in FY 2012 additional cuts to the WRB's budget necessitated additional support from the BRWCT. Reliance upon BRWCT funds to support the state's stream gage network seriously erodes the capacity of the BRWCT to address other priority monitoring needs. **Funding should be restored to state agency budgets to fully operation the RI Streamflow Gage Network.**

Program: RI Department of Health Freshwater Beach Water Quality Monitoring

Description: The RI Department of Health (DoH) Beach Program oversees monitoring and public health notifications for RI's 43 freshwater beaches and 71 saltwater beaches. Sources of contamination at freshwater beaches include outdated septic systems, cesspools and holding tanks, wildlife and waterfowl, and stormwater runoff. The DoH Beach Program uses the federal indicator organism, Enterococci, to determine safe water quality conditions at Rhode Island swimming waters. Beach water quality monitoring efforts are dedicated entirely to saltwater beaches, primarily because the state's only available source of funding for this monitoring requirement is EPA's National Beach Water Quality Monitoring program, which requires that its funds be dedicated to saltwater beaches. Yet RI's freshwater beaches account for about one-third of the state's beach closures. The DoH licenses all recreational facilities in Rhode Island. A licensed recreational facility is required to collect and process beach water samples. In addition to samples collected by beach facility operators, DoH applies a risk-based monitoring assessment to enhance public health protections. Therefore, Rhode Island allows swimming and recreating at licensed freshwater facilities but does not have a program in place to assess sources of contamination.

It's important because…
Children are the highest risk population for contracting water-borne illness from swimming in contaminated bathing waters. 51% of all licensed freshwater facilities are children's summer camps and recreational facilities.


RI DoH Beach Program

$100,000 annually is required for the DOH Beach Program to monitor RI's freshwater beaches.

Implemented by: Partially implemented freshwater Beach facility owners and operators.
State does not fund monitoring of freshwater beach water quality.

Used by: DoH, DEM, Municipalities

Management Values:
- Find and eliminate sources of contamination at licensed freshwater facilities.
- Develop preemptive closure protocols to better protect public health.
- Evaluate monitoring and notification methods currently in place.
- Incorporate cyanobacteria advisories and education to freshwater facilities.

Summer 2011 Data Log…
154 freshwater closure days
13 freshwater closure events
10 freshwater beaches closed to swimming
28% of total beach closure events for 2011
69% of total beach closure days for 2011
23% of freshwater beaches were closed due to elevated bacteria levels (10/43)

Data at:
www.ribeaches.org (for saltwater beaches only)

Current Funding: **Expansion of the DoH Beach Program to include freshwater beaches has not been funded.**

Program: URI Watershed Watch Survey of Un-Assessed Lakes and Ponds

Description: RI has 305 named lakes and ponds, covering ~15% of the state, the highest percentage in New England. In 2011, only 65 freshwater lakes and ponds were monitored seasonally from May through October through the URI Watershed Watch Program (URI-WW). Parameters measured include water clarity, algal density, dissolved oxygen, water temperature, alkalinity and pH, nutrients and bacteria. The capacity of the URI-WW needs to be expanded to allow periodic monitoring of un-assessed lakes and ponds.

It's important because…
Expanding this monitoring program would allow a more complete characterization of lake and pond conditions in RI and encourage timely lake management actions.

Implemented by: **Not currently implemented**

Used by: DEM, EPA, watershed organizations, researchers

Management Values:

- Monitor and assess water quality in lakes and ponds for which there is little water quality data
- Refine and update nutrient water quality criteria and standards
- Support municipal and state TMDL implementation

Data at:

http://www.uri.edu/ce/wq/ww/Data.htm (For data on lakes and ponds being assessed by URI-WW.)

Current Funding: **Expansion of the URI-WW lakes and ponds monitoring program has not been funded.**

RI DEM: Lake Monitoring Volunteer Program

Program: Assess Toxic Contaminant Concentrations in Freshwater Fish: Mercury

Description: One of RI's largest environmental data gaps is toxic contaminant concentrations in freshwater fish tissues. RI has yet to establish its own program to assess fish tissue and the public health risks they may pose. Instead, RI has relied upon limited data generated by US EPA researchers to identify waterbodies that require fish consumption advisories to protect public health. The available data indicates that mercury levels in freshwater fish tissue are often elevated. In 2007-2008, DEM (Division of Fish and Wildlife and Office of Water Resources) and US EPA collected fish tissue data from multiple species in ten lakes and portions of the Pawcatuck and Blackstone Rivers. In 2009, due to reductions in DEM staffing, sampling only took place in two locations (Stafford Pond and Carbuncle Pond). In 2010-2011, new data collection was very limited. DEM is currently working with US EPA to develop a probabilistic sampling design for assessing fish tissue contamination in lakes and ponds. The design would be implemented over a five-year time frame. Additionally, DEM is collaborating with the New England Interstate Water Pollution Control Commission on plans for regional monitoring of mercury in fish tissue aimed at evaluating progress on implementation of the regional mercury TMDL.

It's important because…
Expanding this monitoring program would allow identification of those waters in which fish tissue contamination presents a public health risk and allow Rhode Island to better inform the public of such risks through fish consumption advisories.

Wood Pawcatuck Watershed Association

Implemented by: **Not currently Implemented**

Used by: DEM, DoH

Management Values:

- Assess waters for suitability for fish consumption
- Determine whether or not public health advisories are needed
- Track trends in concentrations of mercury in fish tissues over time

Data at:

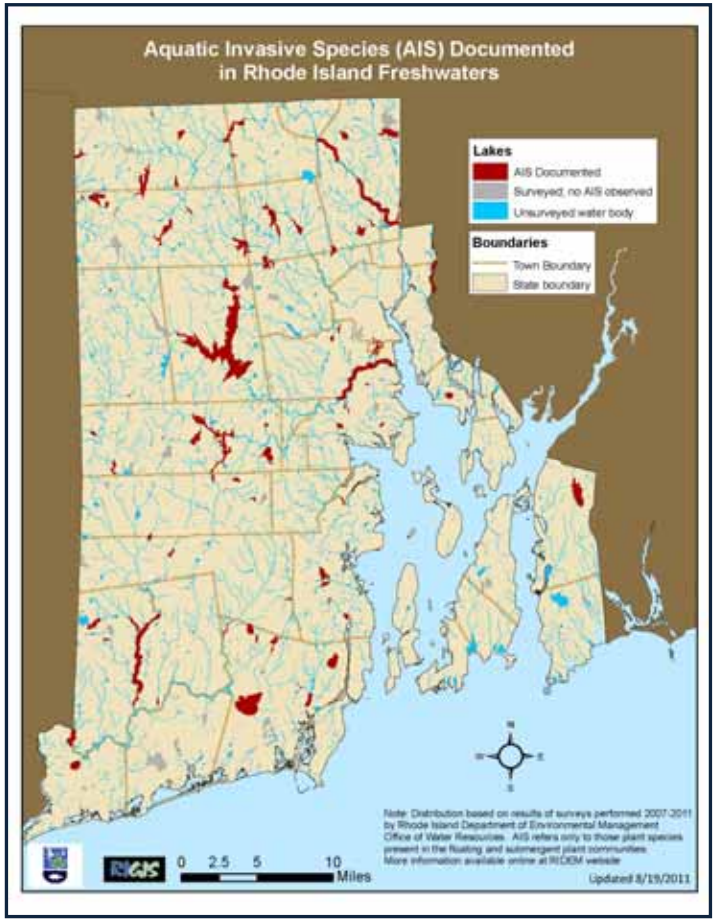
http://www.health.ri.gov/healthyhousing/mercury/fish.php
http://www.neiwpcc.org/mercury/mercurytmdl.asp

Current Funding: **No funding available**

Program: Monitoring the Arrival and Spread of Aquatic Invasive Species

Description: Aquatic invasive species are a widespread management concern in RI freshwaters. DEM continued its seasonal surveys of lakes and ponds with a goal of detecting aquatic invasives species. Data available for 130 lakes and ponds indicated the presence of one or more aquatic invasive plants in 59% of the surveyed waterbodies. Variable milfoil and fanwort were the most commonly detected of the 13 aquatic invasive plants species found. (See DEM report on lakes and ponds for more detail.) DEM also continued to screen rivers and streams for AIS as part of the Rotating Basin Water Quality Monitoring program.

It's important because…
Controlling and eradicating invasive species is easier and costs much less with adequate monitoring. Successful rapid detection and response systems for invasive species require monitoring programs capable of promptly detecting their appearance in RI.



Implemented by: DEM, CRMC, NBNERR, RINHS, and URI-WW

Used by: NBC, DEM, WRB, NBNERR, RINHS, CRMC and USGS

Management Values:

- Characterize the nature and extent of AIS infestation (marine and freshwaters)
- Continue surveillance at select freshwater sites that were of concern the previous year

Data at:
http://www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/invasive.pdf
http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/lakes012.pdf

Current Funding:

FY 2012 US FW/Northeast Aquatic Nuisance Species Council (NEANS), DEM, NBNERR, RINHS, URI
FY2011 US FW/NEANS, DEM, NBNERR, RINHS, URI
FY 2010 US FW/NEANS, DEM, NBNERR, NBEP, RINHS, URI

Future Funding: Vulnerable to Disruption
Unstable funding has hampered development of an effective surveillance, preparedness and rapid response program.

Appendix A:
Major Rhode Island Environmental Monitoring Programs and Recent Monitoring Initiatives

The mission of the **Narragansett Bay Commission** (NBC) is to protect and sustain water quality in Narragansett Bay and its tributaries. NBC's nutrient and pathogen water quality monitoring programs are essential to this mission. New monitoring programs and analyses have been organized recently by NBC's Office of Planning, Policy, and Regulation, with additional efforts planned for 2012 and 2013. In June 2011, NBC convened a major review workshop on current monitoring and research programs focused upon the upper Narragansett Bay estuary and watershed. In 2011, NBC launched a new web site for accessing monitoring data and other information on Narragansett Bay conditions, *Snapshot of the* Bay. NBC also initiated surface water quality mapping as new monitoring initiative in late 2010. Surface mapping involves the collection of high-resolution water quality data in coordination with geographical positioning data.

http://snapshot.narrabay.com/app/.

The **Narragansett Bay Estuary Program** (NBEP) conducts several marine monitoring efforts, and provides assistance to state agencies and the RI Bays, Rivers, and Watersheds Coordination Team in developing and implementing marine monitoring plans. Summer dissolved oxygen distributions are measured by NBEP in a collaborative effort to map the extent and severity of hypoxia (low oxygen) in upper Narragansett Bay. The NBEP also helps to conduct aerial summertime macroalgae surveys using monthly high resolution, GPS stamped, digital photography along the western Bay lower intertidal-subtidal zone. Surveys are conducted monthly during low spring tides from June-September (when algal biomass is at its peak) each year. This project provides baseline conditions of macroalgae location and biomass, important indicators of Narragansett Bay's ecological health. GIS macroalgae distribution maps are provided on the NBEP web site.

www.geo.brown.edu/georesearch/insomniacs

www.nbep.org/

The **Narragansett Bay National Estuarine Research Reserve** (NBNERR) collects a comprehensive suite of abiotic and biological monitoring data. Water quality data are collected continuously from four locations around Prudence Island as part of the national System-wide Monitoring Program. These data are complemented by continuous monitoring of meteorological data at our weather station near Potter Cove and by monthly nutrient and chlorophyll sampling at the four water quality sites. The Reserve is also building a Sentinel Site monitoring program at two of its most pristine salt marshes on Prudence island in order to track changes in marsh structure and function in response to climate change and sea level rise. Finally, the Reserve regularly monitors an array of biological parameters (summarized under a new Biological Monitoring Framework report). Some of these parameters include eelgrass and macroalgae distribution and cover, benthic infauna, invasive crabs, and nekton in estuarine habitats; and songbirds and ticks in upland habitats.

www.nbnerr.org

www.nbnerr.org/Content/NBNERR_Monitoring_Plan_2011.pdf

The **Rhode Island Coastal Resources Management Council** is the State's federally-designated coastal zone management agency. The CRMC in collaboration with the URI Department of Geosciences maintains shoreline change maps depicting erosion and accretion along the coast.

www.crmc.ri.gov/maps.html

The **Rhode Island Department of Environmental Management's** Bureau of Environmental Protection, the **Office of Water Resources** (DEM-OWR) monitors, protects and restores rivers, lakes, wetlands, groundwater and coastal waters in order to support healthy communities of fish, plants, and other aquatic life, as well as sustain ecosystem services such as fishing, swimming, and drinking water supplies. DEM OWR is responsible for using water quality monitoring data to assess the conditions of Rhode Island's surface waters in accordance with the federal Clean Water Act. The results of the assessments of the condition of surface waters are available online and specific data can also be requested from the Surface Water Quality Assessment Program.

Monitoring activities are outlined in the 2005 publication: the Rhode Island Water Quality Monitoring Strategy. Environmental indicators monitored include physical, chemical and biological parameters related to water quality. Several programs are involved in the collection of data including:

- **Ambient River Program**: Collects water quality data from rivers and streams on a rotating basis throughout the state monthly from May-October.
- **Wadeable Stream Macroinvertebrate Program:** Collects macroinvertebrate data from wadeable streams on a rotating basis throughout the state August – September to assess the health of streams and the ability to support aquatic life.
- **Aquatic Invasive Species Surveys**: Monitors lakes and streams on a limited basis in the summertime to map the distribution of aquatic invasive species (presence/absence). Results of monitoring surveys are available online.
- **Narragansett Bay Fixed-Site Network:** DEM, URI, NBC and NBNERR operate a network of fixed sampling stations that provide continuous monitoring of water quality in Narragansett Bay.
- **Shellfish Resource Program:** Monitors shellfish areas in Narragansett Bay to determine which are safe and un-safe harvesting shellfish for human consumption.

http://www.dem.ri.gov/programs/benviron/water/quality/index.htm

The mission of the **Rhode Island Department of Health** (DoH) Beach Program is to protect the public from illness associated with swimming in contaminated bathing waters. The Beach Program achieves this goal by licensing recreational bathing beaches throughout the state. We further this mission by assisting beach owners and managers with finding and eliminating sources of contamination. The Beach Program collects various types of environmental data including Enterococci levels, water temperature, bather load, beach conditions, precipitation, seaweed load, illness complaints, etc.

http://www.health.ri.gov/

www.ribeaches.org

The **Rhode Island Natural History** Survey (RINHS) collects and distributes information on the location and viability of animal and plant species and natural communities in Rhode Island. Ongoing monitoring focuses on rare species and natural communities and invasive species. Data reports are available by request.

http://www.rinhs.org/what-we-do/data/
http://www.rinhs.org/resources

Save the Bay conducts monitoring at two natural eelgrass bed sites in the bay, Ft Getty in Jamestown and T-Dock on the south end of Prudence Island. It sends its data to the SeagrassNet database, a world-wide monitoring database and web site. Save the Bay uses data from natural eelgrass sites to compare with monitoring data conducted at transplant bed sites.

www.seagrassnet.org/research#percentcountry

The **University of Rhode Island Environmental Data Center** (URI EDC) operates within the Department of Natural Resources Science, College of the Environment and Life Sciences at the University of Rhode Island. The URI EDC is staffed with a critical mass of research scientists that specialize in 1) the collection, storage, analysis, display, and distribution of geospatial data and 2) teaching, instruction, and training in the use of geospatial technologies. The URI EDC works closely with the Rhode Island Geographic Information System (RIGIS) Consortium and regional entities on the coordination of geospatial data acquisition and distribution that supports environmental monitoring efforts throughout Rhode Island. During 2010 and 2011, URI EDC through the URI Coastal Institute along with RIGIS represented Rhode Island in the Northeast LiDAR Project whereby a consortium of Northeastern States, lead by the Maine Office of GIS and the USGS Geospatial Liaison Network, secured ARRA funding (with contributing funds from RI Statewide Planning Federal Highway, RI Chapter of The Nature Conservancy, and USDA Natural Resources Conservation Service RI) through USGS to collect high resolution elevation (LIDAR) data covering all of Rhode Island. These data are immediately applicable in flood hazard mapping, sea level rise modeling, ecological climate change habitat assessments, and alternative energy siting.

www.edc.uri.edu

http://www.edc.uri.edu/rigis/data/download/lidar/2011USGS/

The **University of Rhode Island Watershed Watch** (URIWW) program works with DEM, watershed organizations & local communities to assess water quality, and provide information for more effective management of critical water resources. The URIWW produces quality data for a broad range of parameters for over 250 monitoring sites on lakes, ponds, reservoirs, rivers, streams, salt ponds and marine waters statewide. Field monitoring is conducted by trained volunteers typically from May through October either weekly or bi-weekly following well established and documented methods. Field parameters include temperature, dissolved oxygen, clarity and depth. Water samples are collected monthly and processed in a state certified laboratory for nutrients, bacteria, pH, alkalinity, chlorides/salinity and chlorophyll. Data are summarized in tables and charts on the URIWW website with additional formats available upon request.
www.uri.edu/ce/wq/ww/Data.htm

The Rhode Island Environmental Monitoring Strategy shall include the following elements

- ***An inventory of existing monitoring programs;***
- ***An outline of additional monitoring programs the state needs;***
- ***A list of indicators that will be used to measure the health of the marine habitats of the state;***
- ***A list of data standards and protocols that will be used on a reasonable and consistent basis by monitoring programs that contribute data to the state monitoring system;***
- ***A mechanism for data sharing among all monitoring programs that enables both monitors and users to securely access monitoring data via the Internet and to retain the integrity of such data;***
- ***A plan to provide data from the state marine monitoring system for disaster prevention, preparedness, response and recovery efforts in the marine environment;*** **and**
- ***A communications strategy to provide for public access to monitoring data.***

(RIGL 46-31)